



Scott Brown
Remedial Project Manager
East Helena Site
U.S. Environmental Protection Agency
Federal Building - Drawer 10096
301 South Park
Helena, Montana 59626-0026

September 26, 1996

HAND DELIVERED

Dear Scott:

On September 18, 1996, Bob Braico presented the findings of soil sampling that was performed at the former acid plant sediment drying area to Bill Bluck and yourself. These results demonstrated that "removing the soils under the former acid plant sediment drying area are not necessary if the reason for remediating the area is protection of Lower Lake water quality after Lower Lake is remediated." The report further states that, although the former acid plant sediment drying area sub-soils contains metals and arsenic, the geochemical conditions inhibit the migration of metals and arsenic from this area to the groundwater.

For these reasons, Asarco does not believe that removing the former acid plant sediments is justified.

Per our discussion, I am providing the entire report to Susan Zazalli, Bill Bluck, and you for review. I am requesting that, once you have had an opportunity to review the report, we meet to further discuss its conclusions. Since the construction season for any soil removal is quickly closing, I would request that we meet no later than October 2. I will call you on Monday, September 30, 1996.

Sincerely,

Jon Nickel

Encl.

cc: Bill Bluck
Susan Zazalli

Hydrometrics, Inc.

2727 Airport Road • Helena, Montana 59601 • (406) 443-4150 • FAX (406) 443-4155



MEMORANDUM

TO: Jon Nickel, Asarco East Helena

FROM: Bob Braico, Hydrometrics

DATE: September 11, 1996 (revised September 20, 1996).

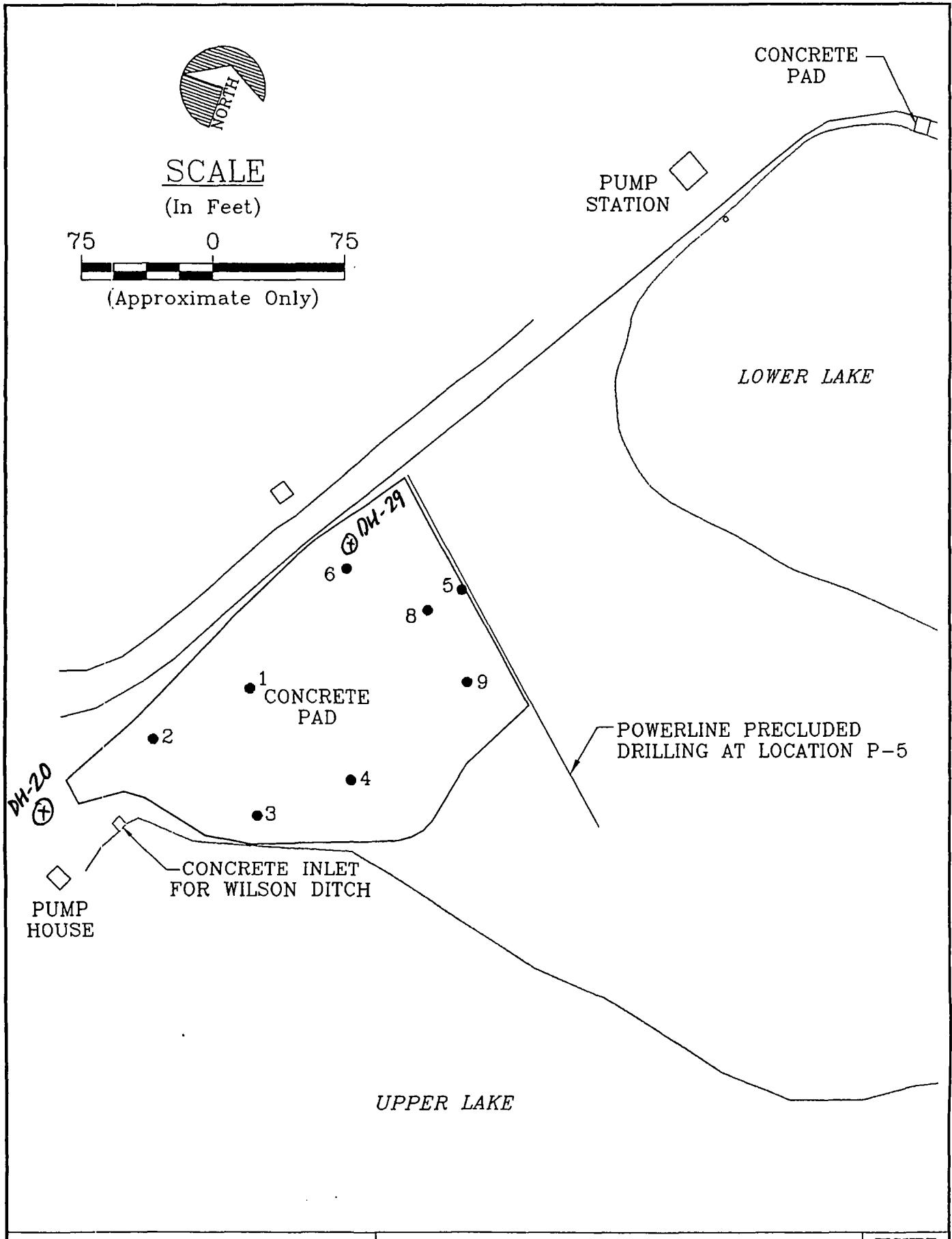
SUBJECT: Soil sampling and analysis at the former Acid Plant Sediment Drying Area.

CC: Richard Marcus, Asarco/SLC
Larry Jensen, Holland & Hart/SLC

METHODOLOGY

Sampling of soil cores at the former acid plant sediment drying area (Figure 1) was conducted on August 16, 1996 at five sites. The samples were collected by split spoon sampling through hollow stem augers using Hydrometrics Mobile B-61 drilling rig. A total of 6 (P1 through P6) boreholes were scheduled to be continuously sampled to a depth of seven feet. However, borehole P5 could not be accessed by the drill rig due to the location of a powerline that is present along the entire northeast edge of the drying pad. This power line precluded the drill rig from setting up any closer than 20 feet from the northeast edge of the pad. In addition, the presence of the two large settling tanks precluded drilling at other locations on the east half of the pad. Samples obtained from borehole P6 should, however, be representative of the poorest soils underlying the east *where is DH-29?* half of the pad since adjacent monitoring well DH-29 has been shown, by periodic monitoring of groundwater quality since 1987, to have been impacted by the past placement of acid plant sludges next to the well. Two additional soil cores, P8 and P9, are scheduled to be collected from the east half of the pad during the week of September 16, 1996 (Figure 1) when the easternmost tank has been removed. Analytical results from sites P8 and P9 will supplement results obtained from borehole P6. *- Where will they have these results?*

At each of the five sampled locations, split spoon samples were collected at 2-foot intervals (Table 1). Sample intervals were 1-3 feet, 3-5 feet, and 5-7 feet. Samples were not collected from the 0 to 1 foot interval because the majority of this interval was concrete. Similarly, samples were not collected below seven feet, the typical water table. Prior to sample collection, a lithologic description of each split spoon sample was recorded. All soil samples at each location appeared to be fill materials consisting of sand, gravel, minor amounts of clay, and significant amounts of sand and fine-gravel size brick and slag fragments.



SEPTEMBER 20 MEMO TO
JOHN NICKEL
ASARCO EAST HELENA

**SOIL SAMPLING LOCATIONS
AT THE FORMER ACID PLANT
DRYING AREA**

FIGURE

1

TABLE 1 SOIL SAMPLES COLLECTED AT THE ACID PLANT SEDIMENT DRYING AREA

LOCATION	SAMPLE NUMBER	SAMPLE INTERVAL		DATE	TIME	BLOWS	RECOVERY (FT)	DESCRIPTION
		FT	bgs*					
P1	P1-1	1-3		8/16/96	9:55	18-16-15-13	1.5	Sand , gravel, slag gravel clay, brown, black fine-coarse sand, clay from 1.5-2.0, dry.
	P1-2	3-5		8/16/96	10:00	5-4-3-3	1.6	Slag, brick, black, red, slag, 3-4', brick fragments 4-5', all material is fine to coarse sand size, unconsolidated.
	P1-3	5-7		8/16/96	10:05	2-2-1-2	1.7	Brick, slag - red, black, slag 5-5.5', bricks 5.5-7.0', sand size, dry.
P2	P2-1	1-3		8/16/96	9:20	13-16-18-13	1.4	Sand, gravel, black, grey fine-coarse sand, dry.
	P2-2	3-5		8/16/96	9:25	5-5-6-4	2	Sand, bricks, red, black grey, very fine-fine grained sand, poorly sorted, slightly moist.
	P2-3	5-7		8/16/96	9:30	2-2-2-3	2	Sand, gravel, bricks, red orange, brown, fine-coarse grained sand, unconsolidated, slightly moist.
P3	P3-1	1-3		8/16/96	10:40	9-11-8-7	1.7	Sand, gravel, bricks, fine-coarse sand size, unconsolidated.
	P3-2	3-5		8/16/96	10:45	3-2-2-2	1.9	Bricks, slag, red, black, fine-coarse sand size, slag from 4.8-5.0, dry.
	P3-3	5-7		8/16/96	10:50	2-2-1-2	1.9	Bricks, slag, bricks 5.0-5.8', slag from 5.8-7.0', fine coarse sand size, unconsolidated dry-slightly moist.
P4	P4-1	1-3		8/16/96	11:15	20-24-16-14	0.9	Slag, sand, gravel, black, grey, wet, fine-coarse grained sand.
	P4-2	3-5		8/16/96	11:20	5-5-3-4	1.6	Slag, sand, gravel, orange brown, fine to coarse sand, trace bricks, unconsolidated, slightly moist.
	P4-3	5-7		8/16/96	11:25	2-1-1-1	1.7	Slag and bricks, sand and gravel size, moist-wet.
P6**	P6-1	1-3		8/16/96	13:25	10-10-13-14	1.6	Sand and gravel, grey, black, trace black slag, clayey, fine to medium sand, moist, slightly consolidated.
	P6-2	3-5		8/16/96	13:30	5-5-10-8	1.5	Sand, gravel, trace clay, dark brown, black, unconsolidated.
	P6-3	5-7		8/16/96	13:35	11-20-14-10	1.5	Slag gravel and sand, black trace red brick, wet.

* bgs = below ground surface

**Note: Sample P7 was collected as a composite duplicate of borehole P6 and labeled with sample time 14:00.

What does Recovery mean

For each 2-foot interval, the contents of the split spoon were placed in a stainless steel mixing bowl and thoroughly mixed. The sample was then divided into three equal portions, placed in ziplock baggies, and labeled. The three representative samples for each interval were then handled as follows:

- One sample was archived for possible later analysis.
- The second sample was later mixed with the other two depth interval samples collected from the same borehole (i.e., representative samples from the 1-3, 3-5 and 5-7 feet intervals of a single borehole were mixed together to obtain a single composite sample) for TCLP analysis of arsenic, mercury, and selenium by Asarco Technical Services Center (TSC) in Salt Lake City, Utah. *got all 8 toxic metals*
- The third sample was later mixed with the other two depth interval samples collected from the same borehole. The resulting single sample for each borehole was submitted for TCLP analysis for barium, cadmium, chromium, lead, and silver by Hydrometrics East Helena Soils Laboratory.
- The composite samples for each borehole were later analyzed by Asarco's TSC for selected total metals and SPLP (EPA Method 1312) metals.

Sample collection thus consisted of one composite sample for each borehole for TCLP, total, and SPLP analyses, and three depth interval samples for each borehole which were archived for possible later analysis. Table 1 summarizes sample collection and lithologic descriptions for each borehole. In addition, a duplicate sample labeled P7 was submitted as a composite duplicate of borehole P6.

Split spoon sampling equipment, and mixing bowls and spoons were decontaminated after each split spoon sample in accordance with Hydrometrics' Standard Operating Procedures for work conducted at the East Helena site. All samples were shipped to the laboratory and stored under proper chain-of-custody.

RESULTS AND DISCUSSION

Sample analyses (Table 2 and Appendix A) show fill underlying the former acid plant sediment drying pad is enriched with arsenic and metals, probably because the materials are industrial fill originating on the smelter site. Extensive soils work at the smelter site (Hydrometrics 1989 and 1990) has shown these materials typically contain elevated arsenic and metal concentrations. The fill may also have been impacted by arsenic and metals in acid plant sludge leachate which seeped through fractures in the overlying concrete drying pad. These impacts to the former drying pad are described in detail in the 90 percent design report for remediation of Lower Lake (Hydrometrics 1994) which also discusses the hydrogeology of the area. TCLP sample analyses show that at boreholes P2, P3, P4 and P6, TCLP cadmium concentrations exceeded the regulatory level of 1.0 mg/2L. The regulatory TCLP lead level of 5.0 mg/L was exceeded at boreholes P1, P2 and P3.

Historical analysis of acid plant sludge - volumes stored, length of time areas extent of

composed

I need a copy of this

TABLE 2. ARSENIC AND METALS ANALYSES FOR SOIL CORES OBTAINED FROM BENEATH THE FORMER ACID PLANT SEDIMENT DRYING AREA BETWEEN UPPER AND LOWER LAKES

Total Concentrations (ppm)										TCLP Concentrations (mg/L)							EPA Method 1312 Concentrations (mg/L)										
Sample No.*	Interval (feet)	Date	Sample																								
			Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	As	Ba	Cd	Cr	Hg**	Pb	Se	Ag	As	Ba	Cd	Cr	Hg**	Pb	Se	
P1-1	1-7	8/10/96	<100	310	2400	<100	290	1.0	4900	<200	<.1	<.10	<10	.34	<.1	<.5	25.1	<.10	<.050	<.10	.16	<.050	<.050	1.4	<.10	<.10	
P2-1	1-7	8/10/96	<100	1600	2100	420	280	2	4800	<200	<.1	3.5	<10	7.82	<.1	<.5	11.3	<.10	<.050	<.10	.20	2.6	<.050	<.50	.67	<.10	
P3-1	1-7	8/10/96	<100	360	2600	<100	310	2	1.0	3100	<200	<.1	1.0	<10	1.20	<.1	<.5	10.2	<.10	<.050	<.10	.14	.061	<.050	.60	<.10	<.10
P4-1	1-7	8/10/96	<100	3100	2200	380	310	2	610	<200	<.1	.27	<10	6.03	<.1	<.5	1.7	<.10	<.050	1.5	.11	.60	<.050	<.50	<.10	<.10	
P6-1	1-7	8/10/96	<100	2900	470	480	170	2	1.5	11,000	<200	<.1	22	<10	4.15	<.1	1.9	.7	.11	<.050	2.6	.11	<.050	<.050	1.2	<.10	<.10
P7-1 (duplicate)	1-7	8/10/96	<100	2900	440	460	<200	3.6	12,800	<200	<.1	22	<10	4.19	<.1	1.2	.9	<.10	<.050	2.9	.11	<.050	<.050	<.50	<.10	<.10	
Regulatory Levels											5.0	5.0	100	1.0	5.0	200	5.0	1.0									

* Although these sample numbers replicate the sample numbers assigned to the 1-3 foot interval at each borehole in Table 1, the sample is over the entire coring interval (i.e., from 1 to 7 feet below the ground surface).

**Mercury (Hg) concentrations are reported in parts per billion (pp).

1 - exceeds Industrial + transfer to GW

2 - exceeds transfer to GW

3 - much higher than typical action levels for Pb

Since neither total nor TCLP analytical methodologies are representative of arsenic and metals concentrations likely to occur as a result of shallow groundwater derived from Upper Lake moving through the fill, the composite samples for each borehole also were analyzed using EPA Method 1312.* Results of analyses using this method (Table 2 and Appendix A), when compared to regulatory levels for TCLP analyses, show only one exceedance (borehole P2). Further, when these laboratory results are combined with groundwater flow direction information from the 90 percent design report for Lower Lake remediation (Figure 2), removing soils beneath the former acid plant sediment drying area is not necessary, if the reason for remediating this area is protection of Lower Lake water quality after Lower Lake is remediated. As shown in Figure 2, groundwater leaving the pad area is discharged west of Lower Lake. When the Consent Decree was entered (December 27, 1990), use of the former acid plant sediment drying area and the former acid plant water reclamation facility had been shown to be impacting the underlying shallow groundwater. Therefore, excavation of sediments underlying these facilities was agreed to by the EPA and Asarco as part of the remediation of these areas. Further, results of in situ pilot scale testing in 1990 suggested at least a portion of the groundwater underlying the former acid plant sediment drying pad was probably entering the southwest corner of Lower Lake. As Figures 2 shows, however, this condition no longer occurs. Why not? how long since change? how did they detect change?

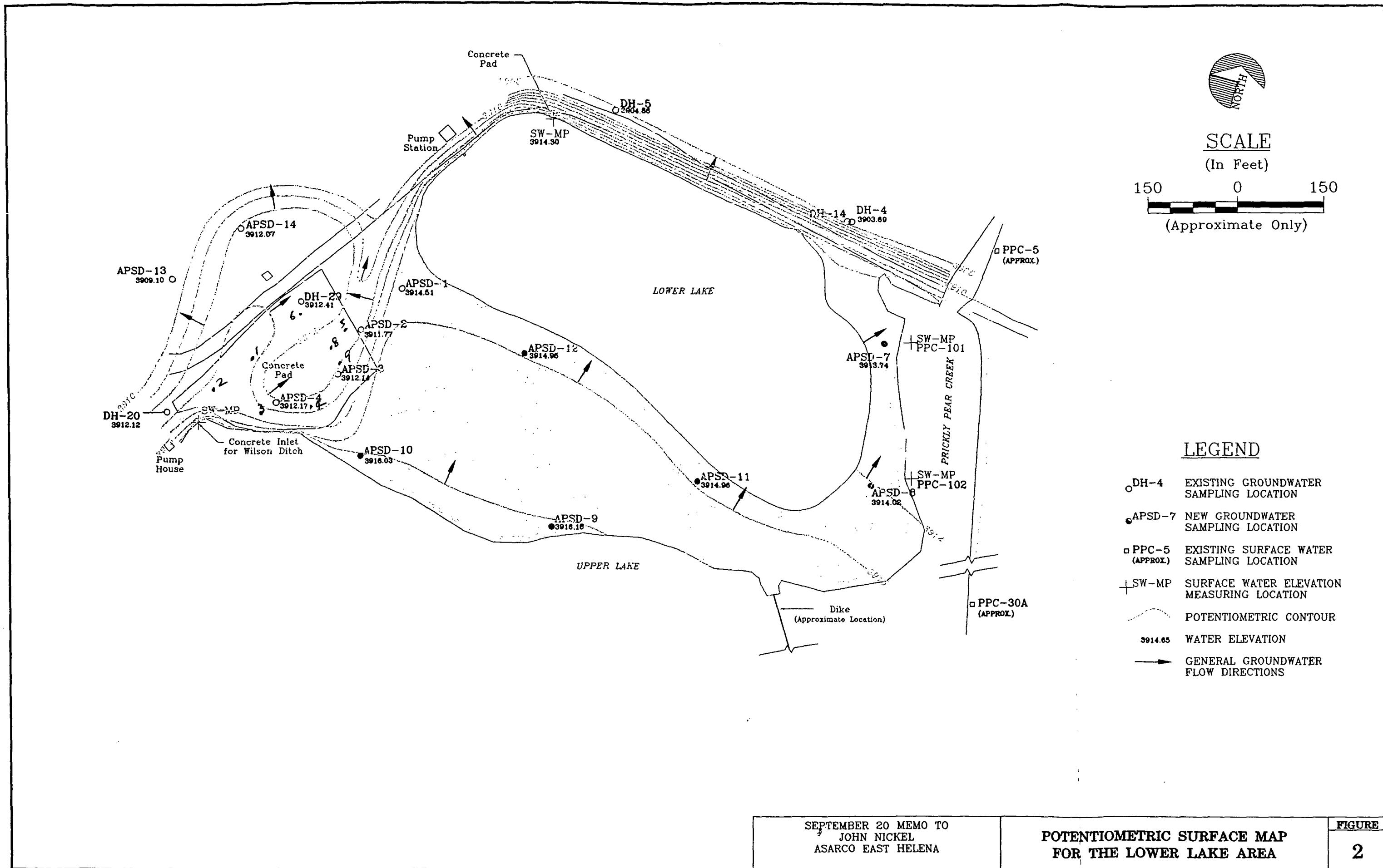
I don't understand what this means

Appendix B is a tabulated summary of groundwater sampling analytical results for monitoring wells DH-20 and DH-29. Well DH-20 is at the southwest corner of the pad and near Upper Lake. Well DH-29 is in the northwest corner of the pad.^{Year selected for borehole 1995} These data show groundwater beneath the pad since spring 1994 (as represented by results from DH-29) is usually well oxygenated, has a pH which is only slightly acidic, contains iron concentrations ranging from 15.1 mg/L to 43.6 mg/L, and while still containing a significant arsenic concentration, has dissolved cadmium ion concentrations which are usually less than 0.005 mg/L. A maximum cadmium concentration of 0.238 mg/L was measured in November 1995. Data contained in the Comprehensive RI/FS for the East Helena Site (Hydrometrics 1990) and a subsequent summary of groundwater data for the area (Hydrometrics 1995) show arsenic present in shallow groundwater beneath the site is "geochemically removed" and no longer present in significant concentrations downgradient of the plant. The precipitation of arsenic in the +5 valence state with iron in the +3 valence state as ferric arsenate is well documented in the technical literature and forms the basis of the design of the HDS plant for achieving very low concentrations of arsenic in plant effluent (Hydrometrics 1996). Because the water in DH-20 is alkaline, well buffered and oxygenated, arsenic and iron present in groundwater beneath the pad should be readily oxidized, precipitated as ferric arsenate and immobilized.

what does this mean

- is this accurate?

* EPA Method 1312 uses unbuffered sulfuric acid/nitric acid solutions at pH 5.0 (for wastes generated west of the Mississippi River) as the leaching media. These solutions are designed to simulate precipitation which would fall on and subsequently leach through a waste. Therefore, these solutions are more representative of conditions at the former drying pad where the primary leaching media is water derived from nearby Upper Lake.



The ESD (Explanation of Significant Difference) issued by EPA in June 17, 1993 for the Process Ponds Operable unit describes a procedure in which the volume of Lower Lake marsh sediments required to be removed was substantially reduced. Analyses of Lower Lake sludges and sediments subsequent to the November 1989 ROD showed that while the sludge layer exhibited characteristics of a hazardous waste, "the underlying marsh sediments were not the source of contamination that they were originally thought to be". As a result, the depth of marsh sediments requiring excavation was reduced to six inches from two feet. Since the fill beneath the former acid plant sediment drying pad is now demonstrably "not the source of contamination it was thought to be" removing this fill no longer appears justified.

Finally, the pad area constitute an active portion of the smelter facility and, up until its use as the site for Lower Lake sediments dewatering, was actively used as a "laydown area" for plant new construction. Therefore, it may be more appropriate to consider soils which underlie the pad together with other plant site soils which have been impacted by historic smelter operations.

I am not
sure that v²
adequately
demonstrates
this.

I may
agree with
this

REFERENCES

- Hydrometrics, Inc., 1989. Process Ponds Remediation Investigation/Feasibility Study, ASARCO Incorporated, East Helena, Montana. Revised September.
- Hydrometrics, Inc., 1990. Comprehensive Remedial Investigation/Feasibility Study. Prepared for ASARCO Incorporated, East Helena, Montana. March.
- Hydrometrics, Inc., 1994. Pre-Final (90%) Design Report (for) Lower Lake Remediation Project for Asarco East Helena Plant. ASARCO Incorporated, East Helena, Montana. March.
- Hydrometrics, Inc., 1995. Asarco East Helena Post-RI Well and Surface Water Monitoring Report (1990-1994). ASARCO Incorporated, East Helena, Montana. June.
- Hydrometrics, Inc., 1996. Final Design Report (for) Improvements to the Asarco East Helena HDS Water Treatment Facility. ASARCO Incorporated, East Helena, Montana. July.
- U.S. EPA Region VIII Montana Operations Office, Record of Decision, East Helena Smelter Site Process Ponds Operable Unit, East Helena, Montana. November 1989.
- United State District Court for the District of Montana, Missoula Division, 1990. Civil Action No. CV 90-46-H-CCL Consent Decree. Entered on December 27.

APPENDIX A

LABORATORY ANALYTICAL RESULTS FOR BOREHOLE SOIL SAMPLES COLLECTED FROM BENEATH THE FORMER ACID PLANT SEDIMENT DRYING PAD

HYDROMETRICS, INC.
2 SOUTH MORTON
EAST HELENA, MT

Project: Lower Lake Soil Borings
Contact person: John Ruth
Date received: 16-Aug-96

Analyst: JDH
Date analyzed: 26-Aug-96

TCLP RESULTS

Lab #	Sample #	Barium	Cadmium	Chromium	Lead	Silver
96X-07118	P1-1	<10	0.34	<0.1	25.1	<0.1
96X-07119	P2-1	<10	7.82	<0.1	11.3	<0.1
96X-07120	P3-1	<10	1.20	<0.1	10.2	<0.1
96X-07121	P4-1	<10	6.03	<0.1	1.7	<0.1
96X-07122	P6-1	<10	4.15	<0.1	0.7	<0.1
96X-07123	P7-1	<10	4.19	0.1	0.9	<0.1

All results reported in mg/L

Lab Duplicate

96X-07120	<10	1.25	<0.1	0.7	<0.1
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Spike Recovery

96X-07121	88%	98%
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ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

East Helena

Water and Solid Waste (Project 3119)

Batch No: L961629

Sample ID	Date	Project	Method	Analyte			Date	Result	Units	Comments
				AS	HG	SE				
L961629-1	16-AUG-96	P1-1	TCLP	<.10	ppm	JJT	20-AUG-96	6010		
				<.5	ppb	VPK	21-AUG-96	245.1		
				<.10	ppm	JJT	20-AUG-96	6010		
L961629-2	16-AUG-96	P2-1	TCLP	3.5	ppm	JJT	20-AUG-96	6010		
				<.5	ppb	VPK	21-AUG-96	245.1		
				<.10	ppm	JJT	20-AUG-96	6010		
L961629-3	16-AUG-96	P3-1	TCLP	1.0	ppm	JJT	20-AUG-96	6010		
				<.5	ppb	VPK	21-AUG-96	245.1		
				<.10	ppm	JJT	20-AUG-96	6010		
L961629-4	16-AUG-96	P4-1	TCLP	.27	ppm	JJT	20-AUG-96	6010		
				<.5	ppb	VPK	21-AUG-96	245.1		
				<.10	ppm	JJT	20-AUG-96	6010		
L961629-5	16-AUG-96	P6-1	TCLP	.22	ppm	JJT	20-AUG-96	6010		
				1.9	ppb	VPK	21-AUG-96	245.1		
				.11	ppm	JJT	20-AUG-96	6010		
L961629-6	16-AUG-96	P7-1	TCLP	.22	ppm	JJT	20-AUG-96	6010		
				1.2	ppb	VPK	21-AUG-96	245.1		
				<.10	ppm	JJT	20-AUG-96	6010		

Vince Bilek
Approved

Ken Bilok
Reviewer

ASARCO

September 3, 1996

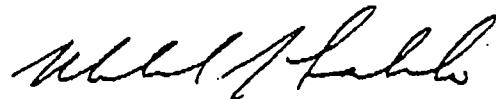
Mr. Bob Braico
HYDROMETRICS INC.
2727 Airport Road
Helena MT 59601

Please find attached the results of total metal analyses performed on six, (6), bulk samples collected on August 16, 1996, and received by the laboratory on August 19, 1996.

At the request of Mr. Jon Nickel, a rigorous digestion was performed with the resultant analyses reflecting the actual metal content of each sample.

If you have any questions regarding the handling or analyses of these samples, please feel free to call me at (801) 263-5243.

Sincerely,



Michael J. Fabbi
Process & Materials
Technician

MJF/jh
Attach.

cc: John Ruth (w/attach.) (Hydrometrics)
Jon Nickel "
GRStanga "
JBRichardson



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ANALYTICAL DATA REPORT

East Helena

Water and Solid Waste (Project 3119)

Batch No: L961695

L961695-1	16-AUG-96	P1-1	AG	<0.010	X	MJF	29-AUG-96	ICP
			AS	0.031	X	MJF	29-AUG-96	ICP
			BA	0.24	X	MJF	29-AUG-96	ICP
			CD	<0.010	X	MJF	29-AUG-96	ICP
			CR	0.029	X	MJF	29-AUG-96	ICP
			HG	1.0	ppm	MJF	29-AUG-96	AA CV
			PB	0.49	X	MJF	29-AUG-96	ICP
			SE	<0.020	X	MJF	29-AUG-96	ICP
L961695-2	16-AUG-96	P2-1	AG	<0.010	X	MJF	29-AUG-96	ICP
			AS	0.16	X	MJF	29-AUG-96	ICP
			BA	0.21	X	MJF	29-AUG-96	ICP
			CD	0.042	X	MJF	29-AUG-96	ICP
			CR	0.028	X	MJF	29-AUG-96	ICP
			HG	1.8	ppm	MJF	29-AUG-96	AA CV
			PB	0.48	X	MJF	29-AUG-96	ICP
			SE	<0.020	X	MJF	29-AUG-96	ICP
L961695-3	16-AUG-96	P3-1	AG	<0.010	X	MJF	29-AUG-96	ICP
			AS	0.036	X	MJF	29-AUG-96	ICP
			BA	0.26	X	MJF	29-AUG-96	ICP
			CD	<0.010	X	MJF	29-AUG-96	ICP
			CR	0.031	X	MJF	29-AUG-96	ICP
			HG	1.0	ppm	MJF	29-AUG-96	AA CV
			PB	0.31	X	MJF	29-AUG-96	ICP
			SE	<0.020	X	MJF	29-AUG-96	ICP
L961695-4	16-AUG-96	P4-1	AG	<0.010	X	MJF	29-AUG-96	ICP
			AS	0.31	X	MJF	29-AUG-96	ICP
			BA	0.22	X	MJF	29-AUG-96	ICP
			CD	0.038	X	MJF	29-AUG-96	ICP
			CR	0.031	X	MJF	29-AUG-96	ICP
			HG	1.2	ppm	MJF	29-AUG-96	AA CV
			PB	0.061	X	MJF	29-AUG-96	ICP
			SE	<0.020	X	MJF	29-AUG-96	ICP
L961695-5	16-AUG-96	P6-1	AG	<0.010	X	MJF	29-AUG-96	ICP
			AS	0.29	X	MJF	29-AUG-96	ICP
			BA	0.047	X	MJF	29-AUG-96	ICP

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

East Helena

Water and Solid Waste (Project 3119)

Batch No: L961695

L961695-5 16-AUG-96 P6-1			CD	0.048	X	MJF	29-AUG-96	ICP
			CR	0.017	X	MJF	29-AUG-96	ICP
			HG	1.5	PPM	MJF	29-AUG-96	AA CV
			PB	1.11	X	MJF	29-AUG-96	ICP
			SE	<0.020	X	MJF	29-AUG-96	ICP
L961695-6 16-AUG-96 P7-1			AG	<0.010	X	MJF	29-AUG-96	ICP
			AS	0.29	X	MJF	29-AUG-96	ICP
			BA	0.044	X	MJF	29-AUG-96	ICP
			CD	0.046	X	MJF	29-AUG-96	ICP
			CR	<0.020	X	MJF	29-AUG-96	ICP
			HG	3.6	PPM	MJF	29-AUG-96	AA CV
			PB	1.28	X	MJF	29-AUG-96	ICP
			SE	<0.020	X	MJF	29-AUG-96	ICP

Approved

Reviewer

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

East Helena

Water and Solid Waste (Project 3119)

Batch No: L961724

ID=801	2649838							
L961724-1	16-AUG-96	P1-1	SPLP	AG	<.050	ppm	JJT	05-SEP-96
				AS	<.10	ppm	JJT	05-SEP-96
				BA	.16	ppm	JJT	05-SEP-96
				CD	<.050	ppm	JJT	05-SEP-96
				CR	<.050	ppm	JJT	05-SEP-96
				HG	1.4	ppb	RDC	30-AUG-96
				PB	<.10	ppm	JJT	05-SEP-96
				SE	<.10	ppm	JJT	05-SEP-96
L961724-2	16-AUG-96	P2-1	SPLP	AG	<.050	ppm	JJT	05-SEP-96
				AS	<.10	ppm	JJT	05-SEP-96
				BA	.20	ppm	JJT	05-SEP-96
				CD	2.6	ppm	JJT	05-SEP-96
				CR	<.050	ppm	JJT	05-SEP-96
				HG	<.50	ppb	RDC	30-AUG-96
				PB	.67	ppm	JJT	05-SEP-96
				SE	<.10	ppm	JJT	05-SEP-96
L961724-3	16-AUG-96	P3-1	SPLP	AG	<.050	ppm	JJT	05-SEP-96
				AS	<.10	ppm	JJT	05-SEP-96
				BA	.14	ppm	JJT	05-SEP-96
				CD	.061	ppm	JJT	05-SEP-96
				CR	<.050	ppm	JJT	05-SEP-96
				HG	.60	ppb	RDC	30-AUG-96
				PB	<.10	ppm	JJT	05-SEP-96
				SE	<.10	ppm	JJT	05-SEP-96
L961724-4	16-AUG-96	P4-1	SPLP	AG	<.050	ppm	JJT	05-SEP-96
				AS	1.5	ppm	JJT	05-SEP-96
				BA	.11	ppm	JJT	05-SEP-96
				CD	.60	ppm	JJT	05-SEP-96
				CR	<.050	ppm	JJT	05-SEP-96
				HG	<.50	ppb	RDC	30-AUG-96
				PB	<.10	ppm	JJT	05-SEP-96
				SE	<.10	ppm	JJT	05-SEP-96
L961724-5	16-AUG-96	P6-1	SPLP	AG	<.050	ppm	JJT	05-SEP-96
				AS	2.6	ppm	JJT	05-SEP-96
				BA	.11	ppm	JJT	05-SEP-96

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

East Helena

Water and Solid Waste (Project 3119)

Batch No: L961724

ID=801	2649838								
L961724-5	16-AUG-96	P6-1	SPLP	CD	<.050	ppm	JJT	05-SEP-96	6010
				CR	<.050	ppm	JJT	05-SEP-96	6010
				HG	1.2	ppb	RDC	30-AUG-96	245.1
				PB	<.10	ppm	JJT	05-SEP-96	6010
				SE	<.10	ppm	JJT	05-SEP-96	6010
L961724-6	16-AUG-96	P7-1	SPLP	AG	<.050	ppm	JJT	05-SEP-96	6010
				AS	2.9	ppm	JJT	05-SEP-96	6010
				BA	.11	ppm	JJT	05-SEP-96	6010
				CD	<.050	ppm	JJT	05-SEP-96	6010
				CR	<.050	ppm	JJT	05-SEP-96	6010
				HG	<.50	ppb	RDC	30-AUG-96	245.1
				PB	<.10	ppm	JJT	05-SEP-96	6010
				SE	<.10	ppm	JJT	05-SEP-96	6010

JKS
Approved
Bilal Dibby
Reviewer

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

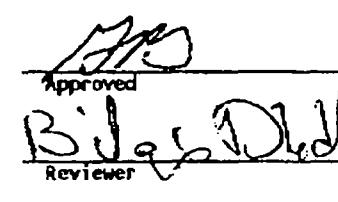
East Helena

Water and Solid Waste (Project 3119)

Batch No: WG961202

~~ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED~~

ID=801	WG961202-5	Detection Limit	CD	.050	ppm	6010
2649838			CR	.050	ppm	6010
			HG	.50	ppb	245.1
			PB	.10	ppm	6010
			SE	.10	ppm	6010



Approved
Billie D. Dally
Reviewer

APPENDIX B

SUMMARY OF WATER QUALITY DATA FOR MONITORING WELLS DH-20 AND DH-29

INDEX

Page	Site Code	Site Name	Site Type	Elevation MP	Well Depth
1	DH-20	DH-20	Groundwater		31
8	DH-29	DH-29	Groundwater		17.00

Sample Type: Groundwater

SITE CODE	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20
SAMPLE DATE	05/12/87	05/12/87	05/12/87	05/12/87	06/30/87	08/11/87	TSC-SLC	08/11/87
LAB	TSC-SLC	TSC-SLC	CHMTC	CHMTC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER								
REMARKS		REPLICATE	SPLIT	REPLICATE				DUPLICATE
SAMPLE NUMBER	8705-103	8705-31	HYD-8990.A17	HYD-8991.A17	8707-110	8708-08	8708-08.A17	

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	16.9	15.98
OXYGEN (O) (FLD) DIS	6.0	0.9
PH (FLD)	7.08	6.6
PH	7.83	7.81
SC (UMHOS/CM AT 25 C)	470.0	510.0
SC (UMHOS/CM AT 25 C) (FLD)	483.2	480.0
TDS (MEASURED AT 180 C)	302.0	365.3
WATER TEMPERATURE (C) (FLD)	11.5	477.5

-- MAJOR CONSTITUENTS --

CALCIUM (CA) DIS	65.4	68.2	67.6	54.0
MAGNESIUM (MG) DIS	19.1	14.7	14.5	13.6
SODIUM (NA) DIS	16.2	16.5	16.2	15.6
POTASSIUM (K) DIS	3.6	3.28	3.3	3.7
BICARBONATE (HCO3)	308.0			282.0
CARBONATE AS CO3	<1.0			<1.0
SULFATE (SO4)	7.0	135.0	<5.0	27.0
CHLORIDE (CL)	4.0	15.0		5.0

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	0.101	0.115	0.106	0.0749	0.119	0.113	0.114
ARSENIC +3	0.09	0.124				0.1176	0.0832
ARSENIC +5	0.012	0.014				0.038	0.0336
CADMIUM (CD) DIS	0.003	0.001	0.008	<0.004		<0.001	0.001
COPPER (CU) DIS	<0.008	<0.008	0.021	<0.017		<0.008	<0.008
IRON (FE) DIS	3.63	3.38	2.61	3.01		5.14	5.25
IRON (FE +2) TOT	2.86	2.84				6.1	6.1
LEAD (PB) DIS	<0.005	<0.005	0.027	0.03		0.005	0.005
MANGANESE (MN) DIS	3.88	3.88	3.51	3.52		3.47	3.4
ZINC (ZN) DIS	<0.008	<0.008	0.026	<0.02		0.01	0.009

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; U1:Blank; J2,U2: Standard; J3:Hold Time; J4,U4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20
SAMPLE DATE	11/23/87	12/07/87	04/29/88	12/15/88	04/12/89	10/18/89	10/18/89	
LAB	TSC-SLC	LKS	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	
LAB NUMBER				89-9	89-485	89-822	89-826	
REMARKS								REPLICATE
SAMPLE NUMBER	8711-235	8711-235.A2	8804-319	AEH-8812-138	AEH-8904-217	AEH-8910-417	AEH-8910-429	

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	16.91	16.8	15.48	15.69	16.33	16.33	
OXYGEN (O) (FLD) DIS	1.2	1.9	2.4	1.1	2.8	2.8	
PH (FLD)	6.71	6.98	7.09	7.05	6.72	6.72	
PH	8.02	8.14	7.1	7.1	7.78	7.78	
SC (UMHOS/CM AT 25 C)	495.0	475.0	470.0	470.0	450.0	450.0	
			J				
SC (UMHOS/CM AT 25 C) (FLD)	472.0	470.6	494.5	486.5	481.6	481.6	
TDS (MEASURED AT 180 C)	324.8	238.0	300.0	279.0	432.0	432.0	
		J	J				

TOTAL SUSPENDED SOLIDS
WATER TEMPERATURE (C) (FLD)

TOTAL SUSPENDED SOLIDS	20.0						
WATER TEMPERATURE (C) (FLD)	10.0		10.8	9.7	10.6	10.6	

-- MAJOR CONSTITUENTS --

CALCIUM (CA) DIS	62.0	69.0					
MAGNESIUM (MG) DIS	13.5	12.0					
SODIUM (NA) DIS	15.7	14.8					
POTASSIUM (K) DIS	4.4	4.0					
BICARBONATE (HCO ₃)	296.0	236.0					
CARBONATE AS CO ₃	<1.0	<1.0					
SULFATE (SO ₄)	<4.0	<2.0	<2.0	<2.0	<2.0	<2.0	
		R					
CHLORIDE (CL)	4.0	5.5	5.0	5.5	4.2	4.2	

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	0.115	0.112	0.138	0.117	0.115	0.128	
		J		J			
ARSENIC +3	0.083	0.04	0.13	0.11	0.083	0.107	
		J		J			
ARSENIC +5	0.092	0.1178	0.06	0.018	0.055	0.028	
		J	J	J	J	J	
CADMIUM (CD) DIS	0.001	0.001	<0.001	<0.002	<0.001	<0.001	
		WJ					
COPPER (CU) DIS	<0.008		<0.008	<0.008	<0.008	<0.008	
IRON (FE) DIS	5.51	5.29					
IRON (FE +2) TOT	6.44	4.8	<0.00558	<0.0055			
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.02	<0.005	<0.005	
		WJ		WJ			
MANGANESE (MN) DIS	3.18						
ZINC (ZN) DIS	<0.008	0.008	0.008	0.011	<0.008	<0.008	
		J	J	J	J	J	

-- HYDROCARBONS --

OIL & GREASE

1.3

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; W1:Blank; J2,W2: Standard; J3:Hold Time; J4,W4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20
SAMPLE DATE	04/28/90	11/30/90	05/07/91	05/07/91	11/15/91	04/22/92	11/12/92
SAMPLE TIME					16:45	11:20	08:20
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	90-1038	90-2251	91-2681	91-2682	91-3855	92-4299	92-6773
REMARKS			DUPLICATE				DUPLICATE
SAMPLE NUMBER	AEH-9005-417	AEH-9011-722	AEH-9105-129	AEH-9105-155	AEH-9111-319	AEH-9204-109	EHC-9211-104
-- PHYSICAL PARAMETERS --							
DEPTH TO WATER LEVEL (FEET)	16.7	16.36	16.6	16.6	16.15	16.04	15.48
OXYGEN (O) (FLD) DIS	2.2	2.05	4.6	4.6	1.9	0.8	1.8
PH (FLD)	7.3	7.24	7.29	7.29	7.61	7.19	6.72
PH	7.76	8.1	7.85	7.84	7.1	7.23	8.0
SC (UMHOS/CM AT 25 C)	450.0	445.0	470.0	475.0	420.0	460.0	390.0
SC (UMHOS/CM AT 25 C) (FLD)	471.1	488.5	478.3	479.3	440.0	450.0	439.0
TDS (MEASURED AT 180 C)	278.0	301.0	321.0	313.0	301.0	283.0	280.0
		J			J3		
WATER TEMPERATURE (C) (FLD)	8.5	9.9	9.5	9.5	14.5	10.0	11.2
-- MAJOR CONSTITUENTS --							
CALCIUM (CA) DIS							62.0
							J2
MAGNESIUM (MG) DIS							13.0
SODIUM (NA) DIS							17.0
POTASSIUM (K) DIS							<5.0
SULFATE (SO4)	<2.0	<2.0 WJ	<2.0	<2.0	5.3	<2.0	2.3 J4
CHLORIDE (CL)	5.3	5.0 J	5.6	5.3	5.1 WJ1,J3	4.7 J2	4.4
-- METALS & MINOR CONSTITUENTS --							
ARSENIC (AS) DIS	0.138	0.129	0.098	0.105	0.175	0.076	0.195 J2,J4
ARSENIC +3	0.112	0.162 UB	0.117 J3	0.108 J3	0.331	0.068	
ARSENIC +5	0.066	0.009 UB	0.035 WJ1,J3	0.042 WJ1,J3	0.08 WJ1	0.024	
CADMIUM (CD) DIS	<0.001	<0.001	<0.002	<0.002	0.0025	0.001	0.001
COPPER (CU) DIS	<0.008	<0.008	<0.004	<0.004	<0.004	<0.004	<0.004
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005 WJ2,WJ4
ZINC (ZN) DIS	<0.006		0.01	0.008	0.032	<0.006	<0.006

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; W1:Blank; J2,W2: Standard; J3:Hold Time; J4,W4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20	DH-20
SAMPLE DATE	11/12/92	11/12/92	11/12/92	04/30/93	11/05/93	04/12/94	07/14/94
SAMPLE TIME		10:00		12:00	15:00	13:30	09:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	93-7131	92-6774	93-7134	93-7735	93-9195	94-592007	94-1209016
REMARKS						PRELIMINARY	
SAMPLE NUMBER	EHC-9211-104	EHC-9211-114	EHC-9211-114	EHC-9305-123	EHC-9311-116	AHCL-9404-169	AHCL-9407-115
-- PHYSICAL PARAMETERS --							
DEPTH TO WATER LEVEL (FEET)		15.48		15.26	16.22	16.15	15.87
OXYGEN (O) (FLD) DIS		1.8		1.6	2.2	1.4	1.4
pH (FLD)		6.72		7.23	7.33	8.23	7.05
pH		8.0					
SC (UMHOS/CM AT 25 C)		380.0		340.0	436.0		
SC (UMHOS/CM AT 25 C) (FLD)		437.0			411.0	426.0	435.0
TDS (MEASURED AT 180 C)		270.0		266.0	276.0	280.0	283.0
WATER TEMPERATURE (C) (FLD)		11.2		9.3	7.3	12.8	10.7
-- MAJOR CONSTITUENTS --							
TOTAL HARDNESS AS CACO ₃					194.0		
CALCIUM (CA) DIS		63.0		58.0			
		J2					
MAGNESIUM (MG) DIS		13.0		12.0			
SODIUM (NA) DIS		17.0		16.0			
POTASSIUM (K) DIS		<5.0		<5.0			
SULFATE (SO ₄)		3.3		<2.0	<2.0		
		J4					
CHLORIDE (CL)		5.0		4.6	5.3		
-- METALS & MINOR CONSTITUENTS --							
ARSENIC (AS) DIS		0.19		0.15	0.128	0.13	.13
		J4				WJ1	
ARSENIC +3	0.15		0.13				
	J2		J2,WJ1				
ARSENIC +5	0.045		0.03				
	J2		J2,WJ1,J4				
CADMIUM (CD) DIS		0.001		0.001	0.001	0.003	.001
						WJ1	
COPPER (CU) DIS		0.005		<0.004	<0.004	<0.004	.004
LEAD (PB) DIS		<0.005		<0.005	<0.005	<0.005	<.005
		WJ2					
ZINC (ZN) DIS		<0.006		<0.006	<0.006	0.017	.011
						WJ1	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; WJ1:Blank; J2,WJ2: Standard; J3:Hold Time; J4,WJ4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-20						
SAMPLE DATE	08/22/94	09/26/94	10/20/94	03/31/95	04/26/95	05/23/95	06/20/95
SAMPLE TIME	09:00	15:30	15:40	13:15	10:00	15:30	12:00
LAB	TSC-SLC						
LAB NUMBER	94-1504003	94-1778025	94-1932011	95-651003	95-826007	95-1057017	95-1280022
SAMPLE NUMBER	AHCL-9408-313	AHCL-9409-413	AHCL-9410-328	AHCL-9503-112	AHCL-9504-109	AHCL-9505-114	AHCL-9506-112

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	16.05	15.26	15.47	16.21	15.22	14.28	14.82
EH (MILLIVOLTS)	-84.3	-52.0	-117.0	-177.0	-36.7	-69.4	
OXYGEN (O ₂) (FLD) DIS	2.6	3.1	3.4	3.71	8.99	2.32	1.87
PH (FLD)	7.2	7.45	7.53	6.65	7.42	7.22	7.09
SC (UMHOS/CM AT 25 C) (FLD)	625.0	413.0	460.0	510.0	408.0	389.0	238.0
TDS (MEASURED AT 180 C)	259.0	296.0	297.0	330.0	266.0	229.0	182.0
			J4			J4	

WATER TEMPERATURE (C) (FLD)	11.3	12.5	11.9	9.0	7.6	8.3	10.1
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-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	0.13	0.12	0.11	0.11	0.108	0.091	0.14
CADMIUM (CD) DIS	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	J4						
COPPER (CU) DIS	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.004
IRON (FE) DIS							3.73
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.026	0.012	0.01	<0.008	0.006	<0.006	<0.02
	WJ1	WJ1			WJ1		

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; WJ1:Blank; J2,WJ2: Standard; J3:Hold Time; J4,WJ4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-20	DH-20						
SAMPLE DATE	07/18/95	08/16/95	09/16/95	09/16/95	10/23/95	10/23/95	10/23/95	11/08/95
SAMPLE TIME	13:40	14:15	10:30	10:45	13:00	13:15	17:00	
LAB	TSC-SLC							
LAB NUMBER	95-1523013	95-1778013	95-2070018	95-2070020	95-2401008	95-2401013	95-2532011	
REMARKS				DUPLICATE		DUPLICATE		

SAMPLE NUMBER AHCL-9507-112 AHCL-9508-112 AHCL-9509-112 AHCL-9509-126 AHCL-9510-112 AHCL-9510-127 AHCL-9511-113

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	15.05	15.14	14.6	14.6	15.8	15.8	14.97
EH (MILLIVOLTS)	-77.94	-139.03	89.0	87.0	139.0	137.0	59.58
OXYGEN (O) (FLD) DIS	2.88	2.82	3.47	3.42	7.24	7.29	1.5
PH (FLD)	7.33	7.59	7.18	7.16	6.96	6.95	6.89
SC (UMHOS/CM AT 25 C) (FLD)	437.0	513.0	516.0	518.0	454.0	452.0	455.0
TDS (MEASURED AT 180 C)	247.0	298.0	296.0	306.0	300.0	302.0	323.0
WATER TEMPERATURE (C) (FLD)	11.2	11.9	11.2	11.3	11.4	11.4	11.6

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	0.12	0.105	0.14	0.12	0.13	0.2	0.124
				J4	J4		
CADMIUM (CD) DIS	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001
COPPER (CU) DIS	<0.008	<0.004	0.008	0.005	0.004	<0.004	<0.008
			UJ1	UJ1			
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-20	DH-20
SAMPLE DATE	05/08/96	06/24/96
SAMPLE TIME	16:10	10:00
LAB	TSC-SLC	TSC-SLC
LAB NUMBER	96-6737	96-1243002
SAMPLE NUMBER	EHC-9605-211	EHC-9606-112

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	15.56	14.95
EH (MILLIVOLTS)	130.72	7.18
OXYGEN (O) (FLD) DIS	3.16	2.78
PH (FLD)	7.24	7.18
SC (UMHOS/CM AT 25 C) (FLD)	476.0	451.0
TDS (MEASURED AT 180 C)	285.0	297.0
WATER TEMPERATURE (C) (FLD)	9.4	10.4

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	0.11	0.11
CADMIUM (CD) DIS	<0.001	<0.001
COPPER (CU) DIS	<0.004	<0.008
LEAD (PB) DIS	<0.005	<0.005
ZINC (ZN) DIS	<0.02	<0.02

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; U1:Blank; J2,U2: Standard; J3:Hold Time; J4,U4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-29	DH-29	DH-29	DH-29	DH-29	DH-29	DH-29	DH-29
SAMPLE DATE	12/18/87	12/18/87	04/29/88	12/20/88	04/19/89	10/24/89		10/24/89
LAB	TSC-SLC	WYRHR	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER				89-43	89-507	89-838		89-841
REMARKS		SPLIT						REPLICATE
SAMPLE NUMBER	8712-303	HYD-9005.A17	8804-327	AEH-8812-146	AEH-8904-225	AEH-8910-425	AEH-8910-432	

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)		6.15	6.55	5.71	5.98	5.98	
OXYGEN (O) (FLD) DIS	1.4	2.5	1.5	1.75	1.8	1.8	
PH (FLD)	6.84	7.0	6.04	5.95	6.25	6.25	
PH	7.52	6.69	6.3	6.5	6.86		
SC (UMHOS/CM AT 25 C)	1800.0	2150.0	2100.0	1550.0	5500.0		
SC (UMHOS/CM AT 25 C) (FLD)	1888.0	2122.0	2298.0	2160.0	5346.0		
TDS (MEASURED AT 180 C)	1525.0	1640.0	1134.0	1562.0	2162.0	4136.0	
					J		
TOTAL SUSPENDED SOLIDS	154.0						
WATER TEMPERATURE (C) (FLD)	9.1		7.5	7.8	8.0	11.6	11.6

-- MAJOR CONSTITUENTS --

CALCIUM (CA) DIS	121.0	137.0	181.0				
MAGNESIUM (MG) DIS	31.5	24.6	36.5				
SODIUM (NA) DIS	225.0	212.0	247.0				
POTASSIUM (K) DIS	16.3	14.6	16.1				
BICARBONATE (HCO3)	375.0	<5.0	248.0				
CARBONATE AS CO3	<1.0	<5.0	<1.0				
SULFATE (SO4)	590.0	510.0	684.0	770.0	663.0	1775.0	
CHLORIDE (CL)	106.0	95.0	113.0	188.0	113.0	64.0	

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	18.9	18.4	43.0	58.0	69.0	229.5	223.2
						J	J
ARSENIC +3	17.1		44.5	53.0	64.2	242.0	235.0
ARSENIC +5	0.49		0.39	0.37	2.66	7.6	8.4
						J	
CADMIUM (CD) DIS	<0.001	<0.0001	<0.001	0.006	<0.002	0.003	0.003
COPPER (CU) DIS	<0.008	<0.003		0.008	<0.008	<0.008	<0.008
IRON (FE) DIS	17.0	15.1	22.1				
IRON (FE +2) TOT	22.4		38.0	0.038	0.0592		
LEAD (PB) DIS	<0.0125	0.005	0.022	0.05	<0.02	<0.005	<0.025
						W	W
MANGANESE (MN) DIS	7.88	7.7					
ZINC (ZN) DIS	0.053	0.05	0.058	0.079	0.508	2.776	2.709
						J	J

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
 TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
 Validation Flags: A:Anomalous; W1:Blank; J2,W2: Standard; J3:Hold Time; J4,W4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-29						
SAMPLE DATE	05/01/90	12/06/90	05/10/91	11/22/91	11/22/91	05/04/92	05/04/92
SAMPLE TIME				09:30	08:00		08:00
LAB	TSC-SLC						
LAB NUMBER	90-1068	90-2264	91-2828	91-3884	91-3890	92-4400	92-4396
REMARKS					Duplicate		DUPPLICATE
SAMPLE NUMBER	AEH-9005-425	AEH-9011-729	AEH-9105-165	AEH-9111-348	AEH-9111-371	AEH-9204-130	AEH-9204-179
-- PHYSICAL PARAMETERS --							
DEPTH TO WATER LEVEL (FEET)	10.33	10.1	8.78	5.86	5.86	5.81	5.81
OXYGEN (O) (FLD) DIS	4.0	2.2	4.8	2.4	2.4	2.1	2.1
pH (FLD)	6.7	6.9	6.03	6.92	6.92	6.46	6.46
pH	7.23	6.66	6.25	5.9	5.9	5.7	5.4
SC (UMHOS/CM AT 25 C)	4300.0	7000.0	7500.0	6200.0	6800.0	4000.0	4000.0
SC (UMHOS/CM AT 25 C) (FLD)	4250.0	6842.0	7471.0	6731.0	6742.0	4150.0	4100.0
TDS (MEASURED AT 180 C)	3226.0	6140.0	6879.0	5273.0	6005.0	3046.0	3102.0
	J	J		J3	J3	J3	J3
WATER TEMPERATURE (C) (FLD)	7.7	9.31	7.7	11.3	11.3	11.4	11.4
-- MAJOR CONSTITUENTS --							
SULFATE (SO4)	1320.0	3029.0	3018.0	2725.0	2632.0	1609.0	1606.0
		J				J3	J3
CHLORIDE (CL)	491.0	764.0	901.0	667.0	729.0	320.0	318.0
		J		J2	J2	J3	J3
-- METALS & MINOR CONSTITUENTS --							
ARSENIC (AS) DIS	223.0	430.0	400.0	330.0	350.0	216.0	216.0
ARSENIC +3	217.0	380.0	382.0	392.0	381.0	217.0	223.0
			J3				
ARSENIC +5	3.4	7.9	8.0	19.9	24.0	2.5	2.5
		JD	J3				
CADMIUM (CD) DIS	0.005	2.0	0.725	0.023	0.027	0.008	0.007
COPPER (CU) DIS	0.018	0.013	<0.004	0.007	0.011	0.005	0.008
LEAD (PB) DIS	<0.025	0.007	0.02	<0.005	0.005	0.037	0.035
		UJD			J4		
ZINC (ZN) DIS	3.38		23.0	15.5	15.9	9.0	8.7

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; U1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-29	DH-29						
SAMPLE DATE	11/22/92	11/22/92	11/22/92	11/22/92	05/07/93	11/16/93	11/16/93	11/16/93
SAMPLE TIME	10:45		10:45		12:50	10:30		10:00
LAB	TSC-SLC	TSC-SLC						
LAB NUMBER	92-6796	93-7179	92-6797	93-7184	93-7847	93-9337	93-9338	
REMARKS	DUPLICATE					PRELIMINARY		DUPLICATE
SAMPLE NUMBER	EHC-9211-161	EHC-9211-161	EHC-9211-178	EHC-9211-178	EHC-9305-174	EHC-9311-123	EHC-9311-180	
-- PHYSICAL PARAMETERS --								
DEPTH TO WATER LEVEL (FEET)	5.86		5.86		5.65	6.9	6.9	
OXYGEN (O) (FLD) DIS	2.1		2.1		2.1	2.7	2.7	
PH (FLD)	6.47		6.47		6.42	6.72	6.72	
PH	5.0		4.8					
SC (UMHOS/CM AT 25 C)	4500.0		4550.0		2980.0	2920.0	AP	
SC (UMHOS/CM AT 25 C) (FLD)	4245.0		4195.0			2915.0	2915.0	
TDS (MEASURED AT 180 C)	3210.0		3330.0		2303.0	2224.0	2177.0	
WATER TEMPERATURE (C) (FLD)	10.8		10.8		8.4	10.3	10.3	
-- MAJOR CONSTITUENTS --								
TOTAL HARDNESS AS CACO ₃					540.0			
CALCIUM (CA) DIS	200.0		205.0		139.0			
	J4,J5		J4,J5					
MAGNESIUM (MG) DIS	63.0		65.0		47.0			
	J5		J5					
SODIUM (NA) DIS	550.0		562.0		440.0			
	J5		J5					
POTASSIUM (K) DIS	51.0		52.0		42.0			
	J5		J5					
SULFATE (SO ₄)	1576.0		1579.0		1025.0	1134.0	AP	
CHLORIDE (CL)	294.0		301.0		187.0	171.0	185.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	240.0		245.0		191.0	102.0	104.0	
ARSENIC +3		226.0		244.0				
	J4		J4					
ARSENIC +5		1.52		2.6				
	J2,J4		J4					
CADMIUM (CD) DIS	0.0025		0.0075		0.003	0.002	0.002	
COPPER (CU) DIS	0.005		0.005		<0.004	<0.004	<0.005	
LEAD (PB) DIS	<0.005		<0.005		0.005	<0.005	<0.01	
	WJ2							
ZINC (ZN) DIS	7.0		7.1		8.0	1.7	1.74	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
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 Validation Flags: A:Anomalous; W1:Blank; J2,W2: Standard; J3:Hold Time; J4,W4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-29	DH-29	DH-29	DH-29	DH-29	DH-29	DH-29
SAMPLE DATE	04/12/94	07/14/94	08/22/94	08/22/94	09/26/94	10/20/94	03/30/95
SAMPLE TIME	14:20	14:40	13:55	13:30	16:15	17:10	12:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	94-592008	94-1209023	94-1504013	94-1504014	94-1778026	94-1932013	95-616011
REMARKS	DUPLICATE						

SAMPLE NUMBER AHCL-9404-170 AHCL-9407-122 AHCL-9408-314 AHCL-9408-328 AHCL-9409-414 AHCL-9410-313 AHCL-9503-113

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	6.53	5.93	5.87	5.87	6.22	6.55	6.66
EH (MILLIVOLTS)					-65.1	-58.0	NO MEAS
OXYGEN (O) (FLD) DIS	2.2	2.0	2.2	2.2	3.7	6.0	8.45
PH (FLD)	6.01	6.82	6.96	6.96	6.74	6.84	6.97
SC (UMHOS/CM AT 25 C) (FLD)	2130.0	2110.0	3190.0	3190.0	2330.0	2680.0	1827.0
TDS (MEASURED AT 180 C)	1561.0	1455.0	1764.0	1788.0	1814.0	1987.0	1203.0
WATER TEMPERATURE (C) (FLD)	10.5	13.4	14.7	14.7	16.5	13.5	6.9

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	92.6	71.0	78.0	85.0	81.0	89.0	63.1
CADMIUM (CD) DIS	0.003	.015	0.005	0.01	0.003	<0.001	<0.001
	W1		J4				
COPPER (CU) DIS	<0.004	<.004	<0.004	<0.004	0.005	<0.004	0.004
LEAD (PB) DIS	<0.005	<.005	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	1.96	1.2	2.0	2.3	1.5	1.1	1.6

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
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Validation Flags: A:Anomalous; W1:Blank; J2,WJ2: Standard; J3:Hold Time; J4,WJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-29						
SAMPLE DATE	04/26/95	05/23/95	06/20/95	07/18/95	08/16/95	09/16/95	10/23/95
SAMPLE TIME	08:00	14:30	12:50	14:30	15:00	09:00	13:30
LAB	TSC-SLC						
LAB NUMBER	95-826008	95-1057014	95-1280023	95-1523014	95-1778014	95-2070019	95-2401012
SAMPLE NUMBER	AHCL-9504-110	AHCL-9505-115	AHCL-9506-113	AHCL-9507-113	AHCL-9508-113	AHCL-9509-113	AHCL-9510-113

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	5.92	5.47	5.05	5.85	7.89	5.57	5.9
EH (MILLIVOLTS)	-105.0	-80.9	-95.1	-116.38	-127.09	115.0	116.0
OXYGEN (O) (FLD) DIS	10.28	5.79	4.54	5.85	5.96	7.47	4.28
PH (FLD)	6.66	6.7	6.69	6.68	6.88	6.8	6.28
SC (UMHOS/CM AT 25 C) (FLD)	1826.0	2190.0	1623.0	2090.0	1679.0	858.0	2732.0
TDS (MEASURED AT 180 C)	1109.0	1304.0	1008.0	1304.0	1242.0	1267.0	2525.0
WATER TEMPERATURE (C) (FLD)	6.5	8.9	10.3	12.5	15.7	13.8	12.9

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	47.5	64.3 J2	49.6	76.1	59.0	64.9	128.0
CADMIUM (CD) DIS	<0.001	<0.001	<0.001	<0.001	0.1	<0.001	0.001
COPPER (CU) DIS	<0.004	0.004	0.004	<0.008	<0.004	0.01 W1	0.005
IRON (FE) DIS		43.6					
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	1.2	3.18	1.43	3.1	1.44	3.6	9.17

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
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Validation Flags: A:Anomalous; W1:Blank; J2,W2: Standard; J3:Hold Time; J4,W4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

Sample Type: Groundwater

SITE CODE	DH-29	DH-29	DH-29
SAMPLE DATE	11/08/95	05/08/96	06/24/96
SAMPLE TIME	18:20	16:50	08:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	95-2532012	96-6725	96-1243003
SAMPLE NUMBER	AHCL-9511-114	EHC-9605-212	EHC-9606-113

-- PHYSICAL PARAMETERS --

DEPTH TO WATER LEVEL (FEET)	9.1	6.38	5.82
EH (MILLIVOLTS)	56.19	60.64	268.0
OXYGEN (O ₂) (FLD) DIS	2.58	8.51	8.18
PH (FLD)	6.59	6.9	6.72
SC (UMHOS/CM AT 25 C) (FLD)	1889.0	3168.0	2130.0
TDS (MEASURED AT 180 C)	1680.0	2496.0	1502.0
WATER TEMPERATURE (C) (FLD)	11.3	7.8	11.0

-- METALS & MINOR CONSTITUENTS --

ARSENIC (AS) DIS	83.72	103.9	58.0
CADMIUM (CD) DIS	0.238	<0.001	<0.001
COPPER (CU) DIS	<0.008	<0.004	<0.008
LEAD (PB) DIS	<0.005	<0.005	<0.005
ZINC (ZN) DIS	6.576	10.27	6.1

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
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 Validation Flags: A:Anomalous; W1:Blank; J2,W2: Standard; J3:Hold Time; J4,W4:Duplicate, Spike, or Split Exceedance;
 R:Rejected.

INDEX

SAMPLE NUMBER ORDER				LAB NUMBER ORDER					
Page	Sample Number	Lab #	Date	Site Code	Page	Lab #	Sample Number	Date	Site Code
1	8705-103		05/12/87	DH-20	1		8705-103	05/12/87	DH-20
1	8705-31		05/12/87	DH-20	1		8705-31	05/12/87	DH-20
1	8707-110		06/30/87	DH-20	1		HYD-8990.A17	05/12/87	DH-20
1	8708-08		08/11/87	DH-20	1		HYD-8991.A17	05/12/87	DH-20
1	8708-08.A17		08/11/87	DH-20	1		8707-110	06/30/87	DH-20
2	8711-235		11/23/87	DH-20	1		8708-08	08/11/87	DH-20
2	8711-235.A2		12/07/87	DH-20	1		8708-08.A17	08/11/87	DH-20
8	8712-303		12/18/87	DH-29	2		8711-235	11/23/87	DH-20
2	8804-319		04/29/88	DH-20	2		8711-235.A2	12/07/87	DH-20
8	8804-327		04/29/88	DH-29	8		8712-303	12/18/87	DH-29
2	AEH-8812-138	89-9	12/15/88	DH-20	8		HYD-9005.A17	12/18/87	DH-29
8	AEH-8812-146	89-43	12/20/88	DH-29	2		8804-319	04/29/88	DH-20
2	AEH-8904-217	89-485	04/12/89	DH-20	8		8804-327	04/29/88	DH-29
8	AEH-8904-225	89-507	04/19/89	DH-29	8	89-43	AEH-8812-146	12/20/88	DH-29
2	AEH-8910-417	89-822	10/18/89	DH-20	2	89-485	AEH-8904-217	04/12/89	DH-20
8	AEH-8910-425	89-838	10/24/89	DH-29	8	89-507	AEH-8904-225	04/19/89	DH-29
2	AEH-8910-429	89-826	10/18/89	DH-20	2	89-822	AEH-8910-417	10/18/89	DH-20
8	AEH-8910-432	89-841	10/24/89	DH-29	2	89-826	AEH-8910-429	10/18/89	DH-20
3	AEH-9005-417	90-1038	04/28/90	DH-20	8	89-838	AEH-8910-425	10/24/89	DH-29
9	AEH-9005-425	90-1068	05/01/90	DH-29	8	89-841	AEH-8910-432	10/24/89	DH-29
3	AEH-9011-722	90-2251	11/30/90	DH-20	2	89-9	AEH-8812-138	12/15/88	DH-20
9	AEH-9011-729	90-2264	12/06/90	DH-29	3	90-1038	AEH-9005-417	04/28/90	DH-20
3	AEH-9105-129	91-2681	05/07/91	DH-20	9	90-1068	AEH-9005-425	05/01/90	DH-29
3	AEH-9105-155	91-2682	05/07/91	DH-20	3	90-2251	AEH-9011-722	11/30/90	DH-20
9	AEH-9105-165	91-2828	05/10/91	DH-29	9	90-2264	AEH-9011-729	12/06/90	DH-29
3	AEH-9111-319	91-3855	11/15/91	DH-20	3	91-2681	AEH-9105-129	05/07/91	DH-20
9	AEH-9111-348	91-3884	11/22/91	DH-29	3	91-2682	AEH-9105-155	05/07/91	DH-20
9	AEH-9111-371	91-3890	11/22/91	DH-29	9	91-2828	AEH-9105-165	05/10/91	DH-29
3	AEH-9204-109	92-4299	04/22/92	DH-20	3	91-3855	AEH-9111-319	11/15/91	DH-20
9	AEH-9204-130	92-4400	05/04/92	DH-29	9	91-3884	AEH-9111-348	11/22/91	DH-29
9	AEH-9204-179	92-4396	05/04/92	DH-29	9	91-3890	AEH-9111-371	11/22/91	DH-29
4	AHCL-9404-169	94-592007	04/12/94	DH-20	3	92-4299	AEH-9204-109	04/22/92	DH-20
11	AHCL-9404-170	94-592008	04/12/94	DH-29	9	92-4396	AEH-9204-179	05/04/92	DH-29
4	AHCL-9407-115	94-1209016	07/14/94	DH-20	9	92-4400	AEH-9204-130	05/04/92	DH-29
11	AHCL-9407-122	94-1209023	07/14/94	DH-29	3	92-6773	EHC-9211-104	11/12/92	DH-20
5	AHCL-9408-313	94-1504003	08/22/94	DH-20	4	92-6774	EHC-9211-114	11/12/92	DH-20
11	AHCL-9408-314	94-1504013	08/22/94	DH-29	10	92-6796	EHC-9211-161	11/22/92	DH-29
11	AHCL-9408-328	94-1504014	08/22/94	DH-29	10	92-6797	EHC-9211-178	11/22/92	DH-29
5	AHCL-9409-413	94-1778025	09/26/94	DH-20	4	93-7131	EHC-9211-104	11/12/92	DH-20
11	AHCL-9409-414	94-1778026	09/26/94	DH-29	4	93-7134	EHC-9211-114	11/12/92	DH-20
11	AHCL-9410-313	94-1932013	10/20/94	DH-29	10	93-7179	EHC-9211-161	11/22/92	DH-29
5	AHCL-9410-328	94-1932011	10/20/94	DH-20	10	93-7184	EHC-9211-178	11/22/92	DH-29
5	AHCL-9503-112	95-651003	03/31/95	DH-20	4	93-7735	EHC-9305-123	04/30/93	DH-20
11	AHCL-9503-113	95-616011	03/30/95	DH-29	10	93-7847	EHC-9305-174	05/07/93	DH-29
5	AHCL-9504-109	95-826007	04/26/95	DH-20	4	93-9195	EHC-9311-116	11/05/93	DH-20
12	AHCL-9504-110	95-826008	04/26/95	DH-29	10	93-9337	EHC-9311-123	11/16/93	DH-29
5	AHCL-9505-114	95-1057017	05/23/95	DH-20	10	93-9338	EHC-9311-180	11/16/93	DH-29
12	AHCL-9505-115	95-1057014	05/23/95	DH-29	4	94-1209016	AHCL-9407-115	07/14/94	DH-20
5	AHCL-9506-112	95-1280022	06/20/95	DH-20	11	94-1209023	AHCL-9407-122	07/14/94	DH-29
12	AHCL-9506-113	95-1280023	06/20/95	DH-29	5	94-1504003	AHCL-9408-313	08/22/94	DH-20
6	AHCL-9507-112	95-1523013	07/18/95	DH-20	11	94-1504013	AHCL-9408-314	08/22/94	DH-29
12	AHCL-9507-113	95-1523014	07/18/95	DH-29	11	94-1504014	AHCL-9408-328	08/22/94	DH-29
6	AHCL-9508-112	95-1778013	08/16/95	DH-20	5	94-1778025	AHCL-9409-413	09/26/94	DH-20
12	AHCL-9508-113	95-1778014	08/16/95	DH-29	11	94-1778026	AHCL-9409-414	09/26/94	DH-29
6	AHCL-9509-112	95-2070018	09/16/95	DH-20	5	94-1932011	AHCL-9410-328	10/20/94	DH-20
12	AHCL-9509-113	95-2070019	09/16/95	DH-29	11	94-1932013	AHCL-9410-313	10/20/94	DH-29
6	AHCL-9509-126	95-2070020	09/16/95	DH-20	4	94-592007	AHCL-9404-169	04/12/94	DH-20
6	AHCL-9510-112	95-2401008	10/23/95	DH-20	11	94-592008	AHCL-9404-170	04/12/94	DH-29
12	AHCL-9510-113	95-2401012	10/23/95	DH-29	12	95-1057014	AHCL-9505-115	05/23/95	DH-29
6	AHCL-9510-127	95-2401013	10/23/95	DH-20	5	95-1057017	AHCL-9505-114	05/23/95	DH-20
6	AHCL-9511-113	95-2532011	11/08/95	DH-20	5	95-1280022	AHCL-9506-112	06/20/95	DH-20
13	AHCL-9511-114	95-2532012	11/08/95	DH-29	12	95-1280023	AHCL-9506-113	06/20/95	DH-29
3	EHC-9211-104	92-6773	11/12/92	DH-20	6	95-1523013	AHCL-9507-112	07/18/95	DH-20
4	EHC-9211-104	93-7131	11/12/92	DH-20	12	95-1523014	AHCL-9507-113	07/18/95	DH-29
4	EHC-9211-114	92-6774	11/12/92	DH-20	6	95-1778013	AHCL-9508-112	08/16/95	DH-20
4	EHC-9211-114	93-7134	11/12/92	DH-20	12	95-1778014	AHCL-9508-113	08/16/95	DH-29
10	EHC-9211-161	92-6796	11/22/92	DH-29	6	95-2070018	AHCL-9509-112	09/16/95	DH-20
10	EHC-9211-161	93-7179	11/22/92	DH-29	12	95-2070019	AHCL-9509-113	09/16/95	DH-29
10	EHC-9211-178	92-6797	11/22/92	DH-29	6	95-2070020	AHCL-9509-126	09/16/95	DH-20
10	EHC-9211-178	93-7184	11/22/92	DH-29	6	95-2401008	AHCL-9510-112	10/23/95	DH-20

INDEX

SAMPLE NUMBER ORDER				LAB NUMBER ORDER					
Page	Sample Number	Lab ##	Date	Page	Lab ##	Sample Number	Date		
							Site Code		
4	EHC-9305-123	93-7735	04/30/93	DH-20	12	95-2401012	AHCL-9510-113	10/23/95	DH-29
10	EHC-9305-174	93-7847	05/07/93	DH-29	6	95-2401013	AHCL-9510-127	10/23/95	DH-20
4	EHC-9311-116	93-9195	11/05/93	DH-20	6	95-2532011	AHCL-9511-113	11/08/95	DH-20
10	EHC-9311-123	93-9337	11/16/93	DH-29	13	95-2532012	AHCL-9511-114	11/08/95	DH-29
10	EHC-9311-180	93-9338	11/16/93	DH-29	11	95-616011	AHCL-9503-113	03/30/95	DH-29
7	EHC-9605-211	96-6737	05/08/96	DH-20	5	95-651003	AHCL-9503-112	03/31/95	DH-20
13	EHC-9605-212	96-6725	05/08/96	DH-29	5	95-826007	AHCL-9504-109	04/26/95	DH-20
7	EHC-9606-112	96-1243002	06/24/96	DH-20	12	95-826008	AHCL-9504-110	04/26/95	DH-29
13	EHC-9606-113	96-1243003	06/24/96	DH-29	7	96-1243002	EHC-9606-112	06/24/96	DH-20
1	HYD-8990.A17		05/12/87	DH-20	13	96-1243003	EHC-9606-113	06/24/96	DH-29
1	HYD-8991.A17		05/12/87	DH-20	13	96-6725	EHC-9605-212	05/08/96	DH-29
8	HYD-9005.A17		12/18/87	DH-29	7	96-6737	EHC-9605-211	05/08/96	DH-20

Ind Res
Soil Ingest.Transfer Soil → GW

As

610 N
3.8 C

As	610 N	23 N		
	3.8C	.43C		
Ba	140,000	5500	350,000	32
Cd	1000	39	920	6

Cr ₃	1×10^6	78,000	—	—
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Cr ₆	10,000	390	140	19
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Pb indispute —————→

Hg	610	23	7	3
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Se	10,000	390	—	3
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Ag	10,000	390	—	—
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